

Furthermore, according to the mobile station locating method of the present invention, it becomes possible to effectively locate the mobile station.

Moreover, when the directional antenna is employed in the base station, it becomes possible to improve the accuracy in the identification of the position of the mobile station.

This invention may be embodied in several forms without departing from the spirit of essential characteristics thereof. The present embodiments as described are therefore intended to be only illustrative and not restrictive, since the scope of the invention is defined by the appended claims rather than by the description preceding them. All changes that fall within the metes and bounds of the claims, or equivalents of such metes and bounds, are therefore intended to be embraced by the claims.

What is claimed is:

1. A method for locating a mobile station based on a mobile communications system, comprising the steps of:

setting a plurality of two-dimensional search areas each being dissected into a predetermined size narrower than a radio zone of each of a plurality of base stations;

pre-obtaining a positional relationship between said base stations and each of said two-dimensional search areas based on mutual time differences reflecting time differences in radio wave propagation between base stations and said two-dimensional search areas;

transmitting characteristic signals from respective base stations to obtain mutual time differences in the propagation times of said characteristic signals between transmission of said characteristic signals at respective base stations and reception thereof at a mobile station; and

identifying a two-dimensional search area where said mobile station is present by comparing the obtained mutual time differences between said characteristic signals with the pre-obtained positional relationship between said base stations and each of said two-dimensional search areas.

2. The mobile station locating method in accordance with claim 1, wherein said base stations transmit said characteristic signals simultaneously, while said mobile station calculates time differences in a reception of said characteristic signals and sends back a calculated result to said base stations.

3. A method for locating a mobile station based on a mobile communications system, comprising the steps of:

setting a plurality of search areas each being narrower than a radio zone of a base station;

defining a positional relationship between each base station and a concerned search area based on mutual time differences in a radio wave propagation between base stations and said concerned search area;

transmitting characteristic signals from respective base stations to obtain mutual time differences in the propagation of said characteristic signals caused between transmission of said characteristic signals at respective base stations and reception at a mobile station, and

identifying a specific search area where said mobile station is present based on said mutual time differences between said characteristic signals,

wherein said base stations transmit said characteristic signals to a target search section, which is successively changed, in such a manner that said characteristic signals arrive at the target search area at the same time, while said mobile station sends back a confirmation

signal to said base stations when said mobile station receives said characteristic signals simultaneously.

4. A mobile station locating system for setting a plurality of two-dimensional search areas each being dissected into a predetermined size narrower than a radio zone of each of a plurality of base stations of a mobile communications system and identifying a specific two-dimensional search area where a mobile station is present, characterized by

a base station including:

characteristic signal generating means for generating a characteristic signal of said base station;

characteristic signal synchronizing means for controlling a transmitting time of said characteristic signal in synchronism with transmitting times of other characteristic signals of other base stations;

positional information memory means for storing positional information of said plurality of two-dimensional search areas in advance, said positional information including positional data of each two-dimensional search area with respect to said base stations;

positional information calculating means for identifying said specific two-dimensional search area where said mobile station is present based on information sent back from said mobile station in response to reception of said characteristic signal, with reference to said positional information stored in said positional information memory means; and

shift hysteresis memory means for storing shift hysteresis of said mobile station, and

said mobile station including:

characteristic signal delay time calculating means for calculating time differences in the propagation of characteristic signals transmitted from respective base stations to the mobile station;

positional information output interface means for outputting positional information of said mobile station to said base stations; and

positional information notifying means for notifying positional information of said mobile station obtained from said base station.

5. The mobile station locating system in accordance with claim 4, wherein said characteristic signal generated from said characteristic signal generating means of said base station comprises one of a group of signals consisting of an intrinsic pulse signal allocated to each base station, a modulation signal modulated differently by each base station, and a characteristic frequency signal allocated to each base station.

6. The mobile station locating system in accordance with claim 4, wherein said positional information calculating means identifies map information representing said specific two-dimensional search area where said mobile station is present based on the positional information stored in said positional information memory means.

7. The mobile station locating system in accordance with claim 6, wherein said map information includes at least one of latitude/longitude, region name and lot number.

8. The mobile station locating system in accordance with claim 4, wherein said positional information notifying means of said mobile station comprises a sound output device generating voice message including said positional information.

9. The mobile station locating system in accordance with claim 4, wherein said base station has a directional antenna to transmit said characteristic signal.

10. The mobile station locating system in accordance with claim 4, wherein said positional information notifying